

## DIMETHYL FORMAMIDE

Dimethyl formamide is a federal hazardous air pollutant and was identified as a toxic air contaminant in April 1993 under AB 2728.

CAS Registry Number: 68-12-2

$\text{HC(O)N(CH}_3)_2$

Molecular Formula:  $\text{C}_3\text{H}_7\text{NO}$

Dimethyl formamide is a colorless to slightly yellow liquid with a faint amine odor. It is miscible with water and most organic solvents (Merck, 1983). Dimethyl formamide is also combustible.

### Physical Properties of Dimethyl Formamide

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Synonyms: n,n-dimethylformamide; DMF; DMFA

Molecular Weight:	73.09
Boiling Point:	153 °C
Melting Point:	-61 °C
Flash Point:	67 °C (153 °F) open cup
Vapor Density:	2.51 (air = 1)
Density/Specific Gravity:	0.9445 at 25/4 °C (water = 1)
Vapor Pressure:	3.7 mm Hg at 25 °C
Log Octanol/Water Partition Coefficient:	-1.01
Conversion Factor:	1 ppm = 2.99 mg/m <sup>3</sup>

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(Howard, 1990; HSDB, 1991; Merck, 1983; Sax, 1989)

## SOURCES AND EMISSIONS

### A. Sources

Dimethyl formamide is used primarily as a solvent for organic compounds where a low rate of evaporation is needed. It is used as a solvent for the formation of acrylic fibers and sheets, electrolytes, in electroplating, films and coatings of other polymeric materials such as polyurethanes, and in the pharmaceutical industry it is used as a crystallization medium for purification of vitamins, hormones, and sulfonamides (HSDB, 1991).

The primary stationary sources that have reported emissions of dimethyl formamide in California are manufacturers of miscellaneous plastics products, miscellaneous manufacturing facilities, and manufacturers of electronic and other electric equipment (ARB, 1997b).

Dimethyl formamide was registered for use as a pesticide; however as of November 29, 1983, it is no longer registered for pesticidal use in California (DPR, 1996).

#### B. Emissions

The total emissions of dimethyl formamide from stationary sources in California are estimated to be at least 18,000 pounds per year, based on data reported under the Air Toxics "Hot Spots" Program (AB 2588) (ARB, 1997b).

#### C. Natural Occurrence

No information about the natural occurrence of dimethyl formamide was found in the readily-available literature.

### **AMBIENT CONCENTRATIONS**

No Air Resources Board data exist for ambient concentrations of dimethyl formamide.

Dimethyl formamide was detected in the air of Lowell, Massachusetts, at a concentration of 8 parts per billion (ppb) (HSDB, 1991). Other locations in the Northeastern United States have reported ambient concentrations of dimethyl formamide ranging from less than 0.02 to 13.8 micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ ) in 1983 with a mean estimated at  $9.8 \mu\text{g}/\text{m}^3$  (U.S. EPA, 1993a).

### **INDOOR SOURCES AND CONCENTRATIONS**

No information about indoor sources and concentrations of dimethyl formamide was found in the readily-available literature.

### **ATMOSPHERIC PERSISTENCE**

Dimethyl formamide is expected to exist almost entirely in the vapor phase in ambient air. Dimethyl formamide is expected to react with photochemically-produced hydroxyl radicals in the atmosphere (Howard, 1990). No information on atmospheric half-life and lifetime was found in the readily-available literature.

## **AB 2588 RISK ASSESSMENT INFORMATION**

Although dimethyl formamide is reported as being emitted in California from stationary sources, no health values (cancer or non-cancer) are listed in the California Air Pollution Control Officers Association Air Toxics “Hot Spots” Program Revised 1992 Risk Assessment Guidelines for use in risk assessments (CAPCOA, 1993).

### **HEALTH EFFECTS**

Probable routes of human exposure to dimethyl formamide are inhalation and dermal contact.

**Non-Cancer:** Dimethyl formamide is a potent liver toxicant in humans. Acute overexposure caused liver damage in humans. Symptoms of acute exposure in humans include abdominal pain, nausea, vomiting, jaundice, alcohol intolerance, and rashes. Dermal exposure may result in dermatitis in humans. Damage to the liver, kidneys, and lungs has been observed in animals acutely exposed to dimethyl formamide by inhalation (U.S. EPA, 1994a).

The United States Environmental Protection Agency (U.S. EPA) has established a Reference Concentration (RfC) of 0.03 milligram per cubic meter ( $\text{mg}/\text{m}^3$ ), based on digestive disturbances and liver effects in humans. The U.S. EPA estimates that inhalation of this concentration or less, over a lifetime, would not likely result in the occurrence of chronic non-cancer effects. The U.S. EPA has not established an oral Reference Dose (RfD) for dimethyl formamide.

The one available study on adverse reproductive effects of dimethyl formamide in humans that reported an increased rate of spontaneous abortions among exposed pregnant women was complicated by concomitant exposure to a number of additional chemicals. In rats exposed by inhalation, reduced implantation efficiency, decreased mean fetal weight, and increased abortions have been reported. In rabbits, exposed by gavage, decreased mean fetal weight and increased percentage of malformed live fetuses per litter and increased percentage of litters with malformed fetuses were observed in the high-dose group (U.S. EPA, 1994a).

**Cancer:** An increase in testicular germ-cell tumors, and cancers of the pharynx or buccal cavity were reported in workers exposed to dimethyl formamide. The U.S. EPA has not classified dimethyl formamide with respect to its carcinogenicity (U.S. EPA, 1994a). The International Agency for Research on Cancer (IARC) has classified dimethyl formamide in Group 2B: Possible human carcinogen based upon limited human evidence (IARC, 1989b).

